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A SCADA Management Strategy for Mobile Industry

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Abstract

Taiwanese mobile telecom industry encounters the difficult of operation and management due to the dispersing of mobile stations and telecommunication system in different areas. Therefore it is the important policy for mobile telecom that how to draft an effective operation method and to drop the cost of management and human resource.

The aim of this research is to study the operation and management cost reduction of the telecom industry through the supervisor control and data acquisition (SCADA) system application during globalization, privatization and liberalization competition. Yet this management system can be proposed functions: prevent faults, eliminating faults fast, operating monitor and to drop the cost of management.

Through literature and empirical analysis, the author found that the SCADA system is applied in telecom industry and mobile stations in Taiwan, the operation and management characteristics can be proposed as follows: (1) Macro Mobile Stations (2) Multi-Task and Multi-User (3) Line/ Modem, OA- LAN stability (4) Real time control program (5) System redundant.

Results indicated that the SCADA system has been highly willing to mobile and telecom industry in the development of power supply quality and to drop the operation and management cost. Also this research aims at measuring the benefit on SCADA system applications in mobile stations and to provide decision-makers and managers with useful operation and management strategies as reference.

Finally, the author suggests that the further research shall focus on the processing equipment characteristics and the management characteristics of other industry with large power demand. It is also desired that a feasible useful management strategy is developed to assist the other industry customer to reduce operation and management cost and to increase the competitive capability.

1. Introduction

1.1 Motivation

Before 1985, the reserved capacity of Taiwan Power Company (TPC) could stably and sufficiently supply the power consumption; our government didn't lay much emphasis on the development of load management policy in power energy. It is therefore that the industries didn't pay much attention on their own power energy management procedures.

From 1985 to 1995, the rapid growth of economy as well as the prosperity of industry and commerce, which result in the increase of power consumption year by year. Besides the construction of nuclear power station and power transmission and distribution was conflict with the doubts of their safety and environmental pollution from the general public. Therefore the projects for power development were hampered by these difficulties and the power supply of on-peak hours was gradually insufficient. Thus our government emphasis on the load management of those industries with large power consumption in this duration. There are therefore many papers and relevant reports related to load management of power energy ready for reference [1][2][3].

Recently, Taiwan government has been putting lots of effort on joining WTO and developing the operation center of Asia Pacific area. With these regards, how to open Taiwanese telecom market to be freely and internationally accessed by other communities is an important issue. However, the government owned companies deliberate our steps for performing on the international stage, since they have been criticized with low operating performance. Therefore, how to privatize the government owned telecom industry efficiently and efficiently is of major interest for the government and public.

Taiwan telecom industry encounters the difficult of operation and management due to the dispersing of mobile stations and communication system. Therefore it is the important policy that how to draft an effective management method and to drop the cost of management.

The aim of this paper is to study the operation and management cost reduction of the telecom industry and through the SCADA system application during globalization and liberalization. Yet the system can be proposed functions: prevent faults, eliminating faults fast, operating monitor and to drop the cost of management.

Now SCADA system applies in telecom stations and mobile stations in Taiwan, the characteristics of management and operation can be proposed as follows: (1) Macro Mobile Stations (2) Multi-Task and Multi-User (3) Line/ Modem, OA- LAN stability (4) Real time control program (5) System redundant [4].

1.2 Trends and Drivers of the Telecom Industry

Trends of deregulation, technological advancement and privatization are causing turmoil in a once stable and highly profitable industry. The advent of competition is exerting continuous pressure on prices with margins falling as a result, and necessitates the introduction of value-added services to sustain volume and profitability. Asia has not been spared these trends, which are global and sweeping in nature. Technology is advancing, with new services such as Internet telephony threatening to gain substantial market share in domestic and international voice traffic at the expense of established telecommunication companies. The pressure will most be felt in international traffic which produces only an estimated 12-15 percent of the revenues of the big operators but 30-40 per cent of profits [5]. Internet telephony is forecast to account for as much as 15-30 per cent of the market for voice and fax calls within five years. Internet telephony is inexpensive, and allows segmentation of the market, where consumers can choose the level of service they require and be charged accordingly. It also enables the provision of several value-added services to consumers, for example real-time billing, cheaper video-conferencing and shortly unified messaging.

In Asia, Internet telephony is said to be a "regulatory minefield", with some countries banning it, others embracing it and some unsure as to how to handle it [6]. Such technological improvements are a huge threat, but also an opportunity for the companies which can be entrepreneurial and innovative enough to invest in and develop further this technology, in an industry shifting from proprietary to open standards, as happened to the computer industry in the 1980s. To become effective competitors in such conditions would require a cultural change for most telecommunication companies, historically operating in a slow-moving, monopolistic and protectionist world. The idea is to create a company run by people who think in terms of a world where the ratio of performance to price doubles every 18 months, and where deals have to be snapped up at once" [7]. Such a cultural change is difficult to achieve; British Telecom, for example, has not made a serious effort at such change, until its dominance in international phone traffic in the UK has been seriously threatened during the last two years [8][9].

The huge overcapacity in telecom, intensifying competition, as well as the Asian financial crisis, are increasing the pressure for consolidation in the Asian telecom industry, where stronger companies may acquire weaker ones, especially newer competitors recently awarded telecom licenses. One interesting outcome of the crisis is that it gives some breathing space to the established players, since challengers find it much harder to realize their expansion plans [5].

The above trends in the telecommunications industry are expected to continue in the future, with even more substantial effects on the telecom companies. The Asian competitive climate in this industry differs in some respects, such as the vast infrastructure investments that have to be carried out in order to improve teledensity rates and service availability and quality. Future trends in Asian telecommunications include those listed in Table 1.1 [10].

Table 1.1 Trends in Asian Telecommunications

1. Strong growth of fixed line and mobile telecommunications networks due to low teledensity rates *(Taiwanese mobile telecom networks are higher)*
2. Acceleration of deregulation and privatization and the resulting increased competition
3. Concession/licensing periods of 15-25 years utilizing the Build-Transfer-Operate model or a variation thereof
4. Strong demand for debt and equity capital to finance expansion
5. Industry rationalization through mergers and acquisitions
6. Technology trends and their pricing impact

1.3 Characteristics and Environment of the Telecom Industry

The trends of business globalization in the late twentieth century enhance the centralization among industries and therefore form business conglomerate. In the latest survey of top-fifty business conglomerate by Common-Wealth Magazine, those industries such as consumer electronics, computer, and communication which are also known as 3C industries were all except communication on the survey lists; however, the communication manufacturing industry which is the most protective industry in Taiwan was excluded from the survey lists.

Since the revenue of their products ranked top 10 around the world in 1985, the information electronic industries have become the benchmarking industries in Taiwan. Besides, the potential markets arising from telecommunication liberalization and privatization have brought the number of information electronic industries into the R&D and manufacture of telecommunication products. And moreover, the widespread applications of Internet help integrate information and communication technologies. Under the trends of the above development, this research considers the managerial strategies of information electronic industry as the basis of investigating strategies of communication manufacturing industry.

In Taiwan, government policies play an important role in the development of communication manufacturing industry. And those impacts can be summarized as six dimensions there are:

(1) The monopoly of telecommunication service business;

(2) Dual roles of Directorate General of Telecommunication as operator and supervisor;
(3) Business managerial model determined by procuring policies of government's telecommunication equipment;
(4) Deeply politic- economic involved digital switching industry;
(5) Transmission equipment industry which is regulated by government procurement policies;
(6) The first liberalized telephone set industry.

Taiwanese telecom operates under very different conditions from the telecommunications providers in the rest of Asia.

2. A SCADA Management Framework Application in Mobile Industry

2.1 The Management Strategy of the SCADA System

In recent years telecom industry has experienced an unprecedented degree of change in management, process technology, customer expectations, supplier attitudes, competitive behavior and many more aspects. Indeed all the evidence suggests that change is now a permanent feature of business environment and that companies which can adapt to this new environment are likely to gain significant competitive advantage.

Thus, using the Porter (1980) generic strategies as a simple illustration, a firm operating an unfocused, differentiated strategy might also be capable of operating a focused differentiated strategy, but not for example an unfocused, least cost strategy [11]. Some transitions between strategies will be relatively easy, others will be more difficult. Abell (1979) suggests that strategy space can be represented as comprising a number of dimensions which might be market, product or technology groups. Within each dimension a number of levels will be open to the organization depending on its strategic competences [12].

Competitive advantage is commonly defined as a position attained by a business unit and perceived by its customers when it is compared with its competitors. They may be characterized as lower cost or differentiation [11]. Focus, which selects one or more segments of the company's advantage and tries to develop competitive advantages, such as A SCADA system.

Now SCADA system applies in telecom stations and mobile stations in Taiwan, the management and operation method can be proposed as follows: (1) Centralize management (2) Disperse management (3) Hierarchical management.

A SCADA system hierarchical management framework include: Central Processor (CP), Terminal Processor (TP), Monitor And Controller (MAC), Sensors and Transducer, such as: figure 2.1 and figure 2.2.

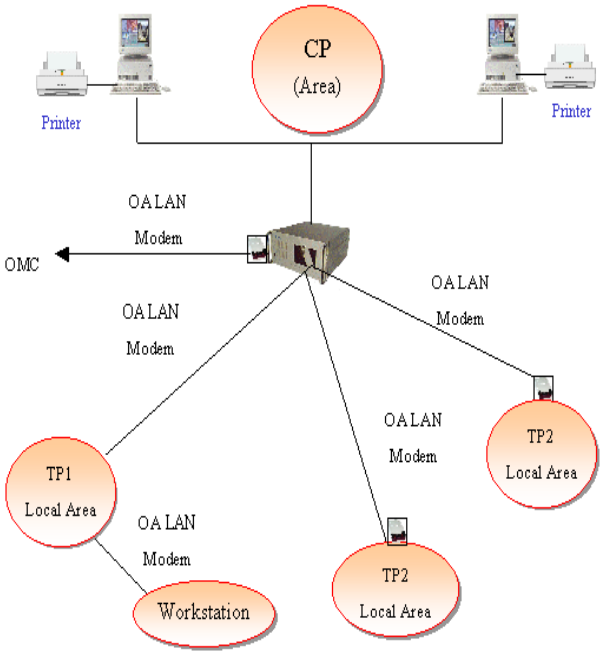

Figure 2.1 The CP Management Framework in SCADA System

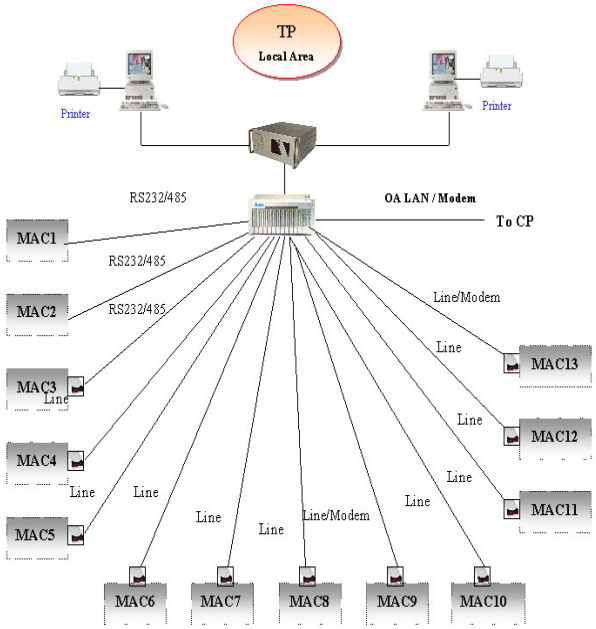

Figure 2.2 The TP Management Framework in SCADA System

2.2 The Equipment of Monitor and Control in Telecom Station

Monitor And Controller (MAC) provides the interface of monitor and control in mobile station (see figure 2.3) [13][14].

Alarm items include as follows:

(a) AC source -- AC current / AC voltage detect
(b) DC equipment -- DC equipment alarm / DC voltage output

(c) Air condition -- Air condition operating status and Temperature
(d) Control Entrance -- Control Entrance detect / Alarm detect

Control item include as follows:

(a) Air condition control -- Air condition operation / Fan / ON-OFF.
(b) DC equipment -- DC equipment alarm / DC voltage output.
(c) BTS Remote Reset / HDLC Modem Loop-Back Test

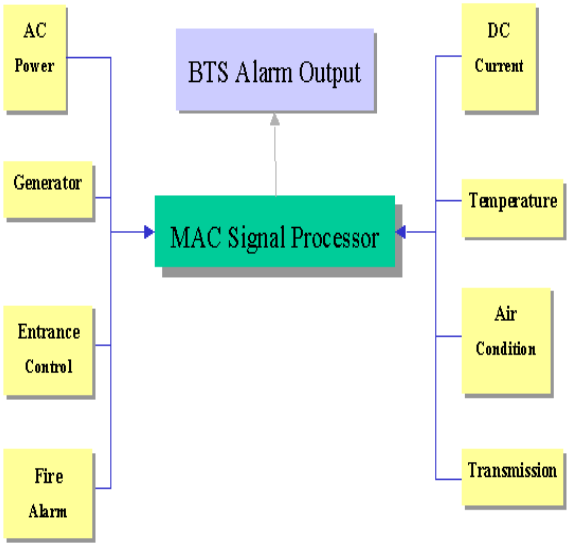

Figure 2.3 The MAC on Monitor and control equipment in SCADA System

2.3 Dialup Modem Application in BS Transmission Network Frame

Dialup Modem application in Basic Station (BS) transmission network. The function include as follows: [13][15][16]

(1) The messages of equipment alarm upload to Base Transceiver Station (BTS) and MAC
(2) Alarm messages through BTS to operator management center (OMC)
(3) OMC through Alarm message to TP
(4) TP use Dial-up method to control MAC and BS
(5) TP use Dial-up method to collect history data period time.

2.4 GPRS Application in BS Transmission Network

General Packet Radio Service (GPRS) application in Basic Station (BS) transmission network. The function include as follows: [13][15][16]

(1) The equipment's alarm upload to BTS and MAC
(2) Alarm message through BTS to operator management center (OMC)
(3) MAC received alarm message through GPRS to TP
(4) TP use GPRS method to control MAC and BS
(5) TP use GPRS method to collect history data during period time.

3. The Affecting Factors on Management Effective in SCADA System

3.1 Foreword

The basic function of SCADA in telecom station and mobile station as follows:

(1) Alarm Real-Time upload -- (a) As alarm take place information OMC immediately (b) System with Real-Time monitor function.
(2) Operating condition inquire -- (a) Operator can inquire equipment condition any time (b) OMC can monitor and control remote telecom station / mobile station operating condition any time.
(3) Auxiliary function -- (a) Run basic control instructions (such as remote control) (b) According special demand to run control instructions, such as Reset (c) Remote fault remove and reduce maintenance cost
(4) History Database -- (a) equipment and management optimization (b) equipment operating record (c) Faults and alarms statistics analysis.

3.2 The Analysis on Factors of Management SCADA System

After evaluating the above-mentioned information related to the SCADA system. Using Delphi method, the author has taken the items of table 3.1 to interview experts, workers and managers of telecom industry and recheck it. The content of the scale is based on a three-round Delphi survey of 10 experts. Finally, the author had concluded the effective measures that are divided into four management dimensions. There are equipment, training, personal and maintenance as bellows:

Table 3.1 The Analysis on Factors of Management SCADA System

Management Dimensions	Factors
Equipments	Network stability and Dual route
	Micro computer Base redundant
	The stability of MAC, Sensors and Transducer
Training	Ignore cultivation plan of worker's skills Accumulation of working experiences cannot really cultivate worker's skills

	Lack of cultivation organization of skill
Personal	Manager's concept neglect worker's skill
	Education and training is ignore
	Worker's concept with effective ideal
Maintenance	Understand software parameter and function
	Operating procedure standardization
	Use software with familiarity
	The speed on alarm of responds and inquire

3.3 To Draft Management Strategy in SCADA System

This section describes the information collection and system management options for the telecom industry and then the decision of management strategy in SCADA system (see table 3.2).

Table 3.2 The Analysis of Management Strategy in SCADA System

Problems	Method/Strategy
Monitor and control system stability	Draft to keep the system stability methods
Technical personnel education and training in SCADA maintenance	Technical personnel education and training
	Training on Training Institute
	Training on work
Lack of full authority by occupation, coordination and integration	There is a consensus of reducing human costs and attaching importance to worker's skills
Software parameter and function operation	Parameter setup by technical and set standard value as reference
Management and operating procedure standardization	Alarm processing procedure standardization and statistics data reports standardization

4. Measure the Effective on Management and Maintenance Network

4.1 The Analysis of Management and Maintenance Network

The section 3 has several factors analysis of management SCADA system. This paper will study and analyze the rate policy of mobile industry and also this section will discuss the effective on management and maintenance framework in SCADA system (see table 4.1). The competitive priority of cost is frequently considered either as a cost reduction or operational excellence strategy. The cost reduction or operational excellence strategy implies a systematic improvement of company operations without the accomplishment of radical innovations.

Table 4.1 The Effective Comparison of Three Framework of Transmission in SCADA System

Framework / Item	Modem / Line	E1 Time Slot Sharing	BTS Node Input Modem Dial-up	BTS Node Input GPRS
Network stability	Medium	High	Medium	Medium
Modem (quantity)	N*2	N*2	N+1	N+1
Transmission equipment cost	Medium	High	Low	High
Line/ Network Maintenance cost	High	Low	Low	Low
Response time of alarm	About 5 sec	About 5 sec	About 5 sec	About 7 sec
Speed of inquire and remote control	About 5 sec	About 5 sec	30-60秒	About 7 sec
Real-Time monitor capability	Yes	Yes	No	No
System development difficulty	Medium	Medium	Low	High
Overall investment cost	High	High	Medium	High

4.2 Measure the Benefit on Operation and Management in SCADA System

A SCADA system, which would provide telecom industry with guidance on:

1. The suitability of using specific competitive strategies in business environments exhibiting particular environmental characteristics;
2. The competencies required to support specific competitive strategies effectively;

3. The ability of the company to compete effectively in a number of future business environments.

Adam and Swamidass (1989) assert that "the core content of a manufacturing strategy include cost, quality, flexibility, and technology" [17,p.182].

・**Costs**

Costs, which means seeking a lower manufacturing cost. The customer expressed willingness in the SCADA system, but the installation of automatic monitor and controller need extra operation cost which therefore reduce the participation willingness from the customer. From the long-term viewpoint, this load management strategy will save electricity cost for the customer. After the explanation, the customer can accept the concept and will proceed to implement this alternative.

With the rapid growth of air conditioner load, the peak loading of customer in summer daytime period increases dramatically and the condition of peak loading in 15-minute leading demand contract becomes more serious. According to the electric price system in TPC, customers are asked to pay extra cost with respect to the portion of basic fee in the case that the peak loading is higher than the demand contract. On the other hand the inappropriate higher demand contract setting can avoid the occurrence of previous stated problem but will results another problem of higher basic electric fee payment. The basic idea of optimal demand contract strategy is to derive a better demand contract such that the annual electric basic cost can be minimized.

・**Quality**

Quality, which means implies offering high quality products and services to the customers.

1. Real-time analysis & reporting
2. Providing comprehensive reports
3. Software are easily operated and well documented.
4. Options of network connection to other systems requiring our data are provided.

・**Flexibility**

Flexibility, mainly related to the innovation of products and services, product mix and production volume. A SCADA system need include: operational flexibility, control flexibility, function flexibility and information system flexibility, etc,.

1. Operator can inquire equipment condition any time.
2. Operator can monitor and control remote telecom station / mobile station operating condition any time.
3. For power monitoring, electroplating process, air conditioning equipments, burn-in room monitoring etc;
4. The Windows-based system can be used to monitor equipment performance and productivity, to diagnose system problems, and to assist maintenance personnel in monitoring alarms.

・**Technology**

The control method of load consumption is another way to reduce electric cost. The load consumption in automatic control can prevent the customer from penalty of exceeding contract capacity. It means when the power consumption climbs up to the climax, this method can get rid of unimportant load or the interruptible electricity equipment.

The rate, which Taiwan Power Company charges to the industrial customer, is the total power consumption in each month, i.e. how much is one kilowatt-hour? In addition, the added rate is defined as "how much is the power consumption climax in one month." The load control device of power consumption aims to prevent the occurrence of new climax with the hope of reducing the added rate.

Owing to the deviation factor, all electricity equipment doesn't operate at the same time. Besides the power consumption is in the status of dynamic variation due to the reasons of the boom-and-bust, season or production and sale plan. The customer has to carry out the control management of load consumption, if the purpose of the economical use on the electricity equipment is required. The monthly power consumption can be reviewed at any time to decrease the electricity cost.

5. Conclusions and Suggestions

5.1 Conclusions

1. Results indicated that the SCADA system has been highly willing to mobile and telecom industry in the development of power supply quality and to drop the operation and management cost. Also this research aims at exploring the benefit on SCADA system applications in mobile stations and to provide decision-makers and leaders with useful operation and management strategies as reference.
2. It is hoped that the conclusion of this research will be adopted by the telecom industry to implement SCADA system decrease rate expenditure and to reduce human cost.
3. The mobile industry is also willing to install the automatic SCADA system, although initial investment need extra cost.

5.2 Suggestions

1. The author suggests that the further research shall focus on the equipment characteristics and the management characteristics of other industry with mass and disperse power equipment. It is also desired that a feasible useful management strategy is developed to assist the other industry customer to reduce operation and management cost and to increase the competitive capability.
2. The final suggestion is that the future research shall

focus on the analysis of power consumption characteristics for the various industries with large power consumption.

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